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MARKETING

LONG- AND MEDIUM-GRAIN RICE:

THE INFLUENCE OF SUPPLY ON WHOLESALE PRICES AND MARGINS

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service
Marketing Research Division
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PREFACE

This study of wholesale prices of long- and medium-grain rice and their seasonal behavior is part of a broad program of research on marketing margins of agricultural products designed to improve the efficiency of the marketing system. Studies of margins for other grains are also planned.

A number of important economic questions are involved in the wholesale marketing of long- and medium-grain rice. What is the most favorable time to sell these two types of rice? What is the competitive relationship between them? How do prices of different types of rice behave in relation to each other during the main part of the marketing season? What are the main forces behind such behavior? To what extent have Federal programs influenced normal price relationship? And, finally, how do seasonal price changes affect milling margins? The purpose of this study is to provide answers to these questions. The information is intended to assist management in making decisions for more efficient marketing.

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SUMMARY

Wholesale prices of both medium- and long-grain rice fluctuated widely at New Orleans during the first 6 months of the rice marketing seasons in the last 10 years. On the average, long-grain rice tended to sell at a premium; its price ranging from about $1.50 to $1.80 per 100 pounds above the price of medium-grain rice. Monthly prices of long-grain rice tended to fluctuate more than the monthly prices of medium-grain rice.

The relation between the prices of different varieties of long-grain rice was significantly closer than the relationship between prices of medium- and long-grain rice. Apparently one long-grain rice is almost a perfect substitute for another long-grain variety, whereas medium-grain rice is not such a perfect substitute for long-grain rice.

Price ratios (relative prices) of medium-grain rice in the New Orleans market and long-grain rice in the Houston market also fluctuated considerably month by month during 1946-53, years in which Government price support programs were not active. However, these ratios were fairly stable when price support programs were active.

Variations in price ratios of medium- and long-grain rice were mainly attributed to changes in supplies of these two types of rice. Mainly because most milled rice is marketed early in the season, early season supplies tended to be abundant. The relationship between the prices of the two types early in the season, therefore, was largely independent of supplies and of changes in demands for different types of rice. As the season progressed and as scarcity developed in one type of rice because of short production, the relationship between the prices reflected more fully early season supplies. Thus, in September, for example, annual supply ratios of medium- to long-grain rice explained only about 31 percent of the variations in their respective price ratios. Increasing proportions of the variations in monthly price ratios were explained by annual supply ratios as the season advanced. By February variations in the annual supply ratios explained 91 percent of the variations in February price ratios.

Prices of the type of rice in short production tended to increase above their normal level to the prices of other types only after the season had progressed. On the other hand, prices of the type of rice in large production followed a reverse pattern. Such seasonal fluctuations could be reduced considerably if more millers could hold the type of rice in short supply for later sales. With only a few millers in a position to follow this policy, gross milling margins may have been considerably higher in some years than they would otherwise have been.

Under Federal programs for rice, monthly wholesale prices tend to reflect price support rates which are announced before the marketing season. Since these rates are fixed, wholesale prices tend to remain stable when rice is effectively supported by Federal programs and the composition of the rice crop will seldom affect their prices during the marketing season.

The composition of the rice crop during periods of effective Federal programs tends to be influenced, among other things, by differences in price support rates. When one type of rice is supported above its normal level to other types of rice, its production is encouraged at the expense of the other types. As a result, the type which is supported at the higher level moves into Government storage, and mills have to compete with support rates. On the other hand, the type of rice which is supported at the lower level will become scarce and millers will have to pay substantial premiums over support rates in order to obtain this type of rice. This in turn adversely affects milling margins.

The economic model developed in the appendix provides a guide for rice millers, to aid them to sell different types of rice at different times of the season in the absence of Federal programs. With Federal programs in effect no such guide is necessary, for the relationship between prices tends to remain stable. The model also suggests a possible method for establishing support rates for medium- and long-grain rice, which may have the effect of normalizing relative supplies in trade and Government storage and avoiding the creation of unnecessary shortages in some types of rice.

MARKETING LONG- AND MEDIUM-GRAIN RICE

The Influence of Supply on Wholesale Prices and Margins

By Nicholas M. Thuroczy, agricultural economist
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Three main types of rice are grown in this country, long, medium, and short grain. Each type of rice is preferred over other types in different outlets, including the export market, as indicated by the predominant movements of the same type of rice in the same outlets. 1/ Variations in the demand for different types of rice or variations in the relative supplies, will affect the prices of alternative types differently, even within a marketing season.

Wholesale prices of medium- and long-grain rice are influenced by the quantities of the different types of rice demanded and the supply of these different types. 2/ To the extent, however, that medium- and long-grain rice are good but not perfect substitutes, and that consumer preferences for the two kinds of rice remain relatively stable, supplies of these types of rice become the influencing factor in determining relative prices. Prices of these different types of rice, however, will not necessarily maintain the same relationship during any given season.

Instability in the relative wholesale price levels of the two types during any marketing season results in a risk element in milling for those millers who produce milled rice for the wholesale trade. Millers, of course, would like to avoid or at least minimize this risk. Marketing costs might be reduced and returns to growers increased, or retail prices decreased, if this risk could be minimized. At the time millers purchase rough rice, they are confronted with the problem of estimating not only the future general level of the prices of rice but also the level for the specific types and varieties of rice, since sales of milled rice sometimes follow several months later. The problem of estimating future relative prices of the different types of rice is greatest for those mills handling two or more varieties. Miscalculation of future prices may increase considerably their gross milling costs.

1/ For example, it is known that medium-grain rice is preferred in some of the Southern States and Puerto Rico, whereas long-grain rice is preferred in other States and Cuba. A preference, however, for one type of rice does not necessarily exclude the use of less preferred types if the preferred type is not readily available at the price favorable to the consumer.

2/ Within a given type of rice there are usually a number of varieties, having different attributes, such as heat resistance, earlier or later maturity, and cooking quality.

OBJECTIVES AND METHODOLOGY

The first objective of this report is to examine the behavior of wholesale prices of selected varieties of long- and medium-grain rice during the major part of the marketing season and why they behave as they do. In order to accomplish this objective, price relationships among different types and varieties of rice are measured, relationships between relative wholesale price and relative production levels are established, and finally the effect of the Government programs upon these relationships are evaluated.

The second objective is to appraise the impact of seasonal changes in the relative wholesale prices upon milling margins and costs of marketing for millers handling different types of rice for the wholesale trade. Some of the means by which stability in relative price levels could be achieved and consequently costs of marketing reduced are also shown.

Actual wholesale prices at New Orleans for medium- and long-grain rice and at Houston for long-grain rice, together with annual production of the two types of rice, are the basic secondary data for the statistical analysis.

The underlying assumption of the entire study is that medium- and long-grain rice are fairly good substitutes for one another. For some consumer groups in the domestic and in selected foreign markets, one type of rice may be a comparatively poor substitute for another type. But, for another group, the two types of rice may be good substitutes. This distinction between the preferences of individual consumers is substantially diminished if an entire market area or total demand forces are analyzed.

In general, the effect of the second group upon rice consumption was stronger than the effect of the first group. While preferences were still reflected in price differentials between the two types of rice, no significant end-of-year carryovers could be observed in the face of considerable yearly variations in the output of both long- and medium-grain rice. This was the case until about 1954 when Federal programs became effective. Thus, considering total utilization, medium- and long-grain rice may each be a fairly good substitute for the other.

Price analysis must of necessity be based upon historical relationships, but the experience of the past, when based upon relationships and the factors influencing them, can be of considerable value in planning for the future.

SUPPLY OF RICE

United States rice production has more than doubled since the beginning of World War II. For 1954, production of rough rice amounted to 64 million hundredweight, reflecting both increase in acreage and increase in the yield per acre. Within this increased production, however, significant shifts were taking place in the composition of the rice crop. This may be demonstrated by trends in acreage of different types of rice in table 1.

Acreage of medium-grain rice exceeded acreage of long-grain types until about 1946. Since this date, except for 1948, harvested acreage of long-grain rice has exceeded acreage of other types. The upward trend in acreage in long-grain types of rice has been continuous, and relatively sharp since 1935, largely because of the increased amount of long-grain rice exported to Cuban markets. Acreage of medium-grain rice has varied from year to year but the trend was not apparent until 1954. The sharp and continuous decline in medium-grain acreage since 1954 has largely been attributed to the current price support program, which made long-grain rice a more profitable crop to grow. As shown in later sections, support rates for several varieties of long-grain rice have been more favorable than support rates for medium-grain rice.

Acreage of short-grain rice, grown predominantly in California, has also increased. Acreage in Texas and Louisiana has been small, but recently some upsurge in this type of rice has occurred in Arkansas. However, short-grain rice is still relatively unimportant in that State compared with other types.

In Texas, the acreage of medium-grain rice has constantly declined; this decline has been more than offset by long-grain varieties. In Louisiana the acreage has declined a little, but the increase in long-grain acreage has been somewhat smaller than in Texas.

In other minor rice-producing States of the South, the trend in acreage has been the same.

BEHAVIOR OF WHOLESALE PRICES

Wholesale market price quotations of milled rice at New Orleans were selected for this part of the study. It is assumed that New Orleans reflects adequately aggregate demand and supply conditions. Prices of three main varieties of rice were studied from October to March inclusive in the period 1947-57. 3/ Rexoro and Blue Bonnet representing the long-grain and Zenith representing medium-grain prices were selected. 4/ Production of the three varieties accounts for about two-thirds of the entire Southern rice crop.

Average Prices

Monthly prices considered in this study are charted in figure 1. Prices fluctuated considerably in the last 10 years, both from one year to the next

3/ This period has been selected because under normal conditions a relatively small amount of rice moves from mills to the wholesale trade in April-September. September shipments in some years may be large, but in many instances the availability of old crop rice may adversely influence price relationships in that month.

4/ Here and on the following pages the terms Zenith and medium-grain rice are used interchangeably.

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Table 1.--Rice acreage harvested, by types, United States, 1931-56

Year of harvest	Long grain	Medium grain	Short grain
	1,000 acres	1,000 acres	1,000 acres
1931	135	709	137
1932	123	603	130
1933	67	601	120
1934	66	584	116
1935	117	572	106
1936	150	657	140
1937	134	841	144
1938	223	704	145
1939	229	677	140
1940	224	711	151
1941	235	827	157
1942	352	898	200
1943	376	858	243
1944	414	829	262
1945	563	685	278
1946	741	526	291
1947	833	561	276
1948	749	752	241
1949	798	694	305
1950	831	534	264
1951	1,034	608	303
1952	993	649	338
1953	947	775	418
1954	1,093	825	482
1955	967	559	363
1956	972	352	295

The Rice Millers' Association. Rice Acreage in the United States. Annual reports.

and during any marketing season. Prices of the two long-grain types of rice tended to be higher than the price of medium-grain rice. 5/ The three price series followed a similar pattern.

5/ In general Zenith has a higher per acre and milling yield than some of the long-grain rice varieties. Production costs on the farm and in the mills are also somewhat lower for Zenith than the same costs for some long-grain varieties. Combining these factors with preferences for long-grain rice, prices of long-grain rice in general tend to be higher than the prices of Zenith and other varieties of medium-grain rice.

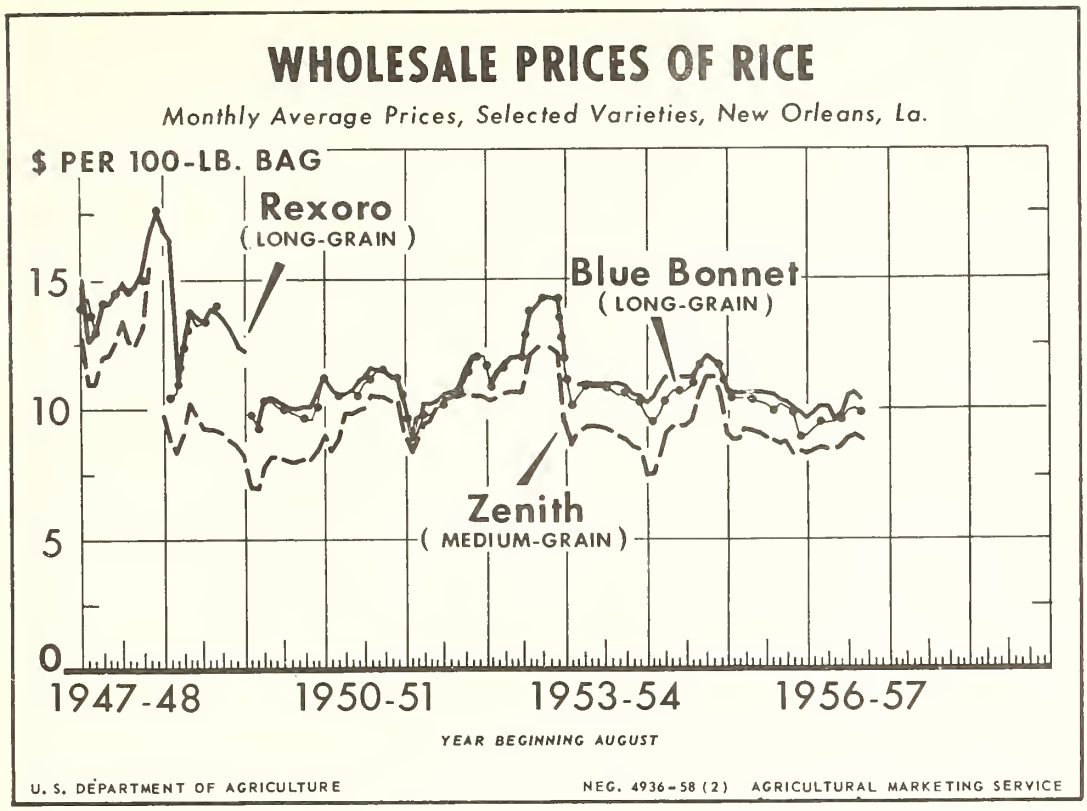

Figure 1

A closer look at these price series, however, indicates many differences, particularly if their seasonal behavior is observed. The range for October-March fluctuations is shown in table 2. On the average, prices in almost all cases tended to advance as the season progressed. The largest increase occurred during October. Price advances in some months exceeded storage charges significantly. Prices tended to stabilize by January, and by March the increase became larger. According to this measure there appears to be no evidence that one price series changes significantly more from one month to the next than the other price series.

Variability

Prices of long-grain rice tended to fluctuate more in absolute terms than prices of medium-grain rice. However, when relative variabilities are considered, these differences tend to become less conspicuous. 6/ In relation to their average levels the monthly wholesale price of Zenith tended to fluctuate somewhat less than the wholesale price of Blue Bonnet, but in some months somewhat more than Rexoro.

6/ Statistical measurement of different variabilities are tabulated in Appendix A, table 8.

Table 2.--Monthly wholesale price per 100 pounds for selected varieties of rice, New Orleans, La., 10-year average, October-March 1947-57

Type and variety	Average monthly wholesale price, 1947-57					
	October	November	December	January	February	March
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Medium grain:						
Zenith	8.97	9.52	9.72	9.77	9.85	9.99
Long grain:						
Rexoro	10.78	11.29	11.39	11.50	11.55	11.81
Blue Bonnet	10.44	11.02	11.22	11.21	11.36	11.55

Computed from table 6.

Relationships

During October over the period 1947-57 about 68 percent of the price changes in Zenith were explained by price changes in the long-grain rice (or vice versa). However, in the same month, 92 percent of the variations in the price of one variety of long-grain rice could be explained by variations in the price of another long-grain variety. As the season progressed, the degree of association between long- and medium-grain rice gradually declined, and in March it became only about 58 percent (a decline in the degree of association of about 10 percentage points from the beginning of the season). The association between the price series for the two long-grain varieties gradually increased as the season progressed and by March the association had become 99 percent (an increase of about 7 percentage points since October). 7/

As a general tendency, the relationship between prices of long- and medium-grain rice tends to decline as the season advances, while the association between the price series for long-grain rice tends to increase as the season progresses.

The two varieties of long-grain rice are apparently almost perfect substitutes, one for the other, in the wholesale market. However, varieties of long- and medium-grain rice are apparently less readily substituted for each other. Presumably, many buyers for domestic and foreign markets are indifferent concerning the variety of long-grain (or medium-grain) rice, but they are perhaps not as indifferent with respect to type of rice.

7/ The degree of association between selected price series are tabulated in Appendix A, table 9. From one month to the next, changes in the association between the two price series may not be very sifnificant; however, over several months the trend becomes apparent.

The relatively higher interdependence between prices of long- and medium-grain rice at the beginning of the season might be attributed to the seasonal marketing of the two types of rice and to their relative abundance in supplies. In some parts of the South, medium-grain rice is harvested and marketed earlier than other types; thus, markets for this type of rice are also established earlier. When long-grain rice first reaches the market, it follows the price movement of medium-grain rice somewhat closer than it does later in the season. This occurs partially because there is no immediate clear indication of the market for long-grain rice in the wholesale trade. Further, early in the season, supplies are also abundant and variations in demand for different types of rice will not cause significant changes in relative price levels. Later, however, price movements of the two types of rice become more and more independent of each other, and prices largely reflect the reduced supplies of the different types of rice.

The relatively smaller association between the price series of the two long-grain types of rice at the beginning of the season might be explained by demands of some food manufacturers for specific varieties. Prices of such rice may behave differently from prices of other varieties for which no specific demands exist. Later in the season, when most industrial demands have been met, prices of long-grain rice move almost parallel and one variety becomes almost a perfect substitute for another variety.

Sensitivity

In order to carry out their marketing decisions, millers may often be forced to estimate changes in the wholesale price of one type of rice by observing what happens to the price of another type of rice.

The monthly wholesale price of medium-grain rice responded less readily, on the average, to simultaneous changes in the monthly wholesale price of long-grain rice than the price of another variety of long-grain rice did. During December, for example, a $1 change in the price of Rexoro accompanied about a 64-cent change in the price of Zenith in the same direction, and a $1 change in the price of Blue Bonnet accompanied about a 60-cent change in the price of Zenith. On the other hand, in the same month a $1 change in the price of Blue Bonnet accompanied about a 90-cent change in the price of Rexoro. 8/

Figures 2 and 3 show a clearer picture of the simultaneous price change between selected varieties of rice. The horizontal axes represent month-to-month wholesale price changes--from October to November and from November to December--for the two varieties of long-grain rice, Blue Bonnet and Rexoro, respectively, during 1947-56. The vertical axes represent the monthly changes in the wholesale price of Rexoro and Zenith, respectively, during the same

8/ Simultaneous monthly price changes are tabulated in Appendix A, table 10.

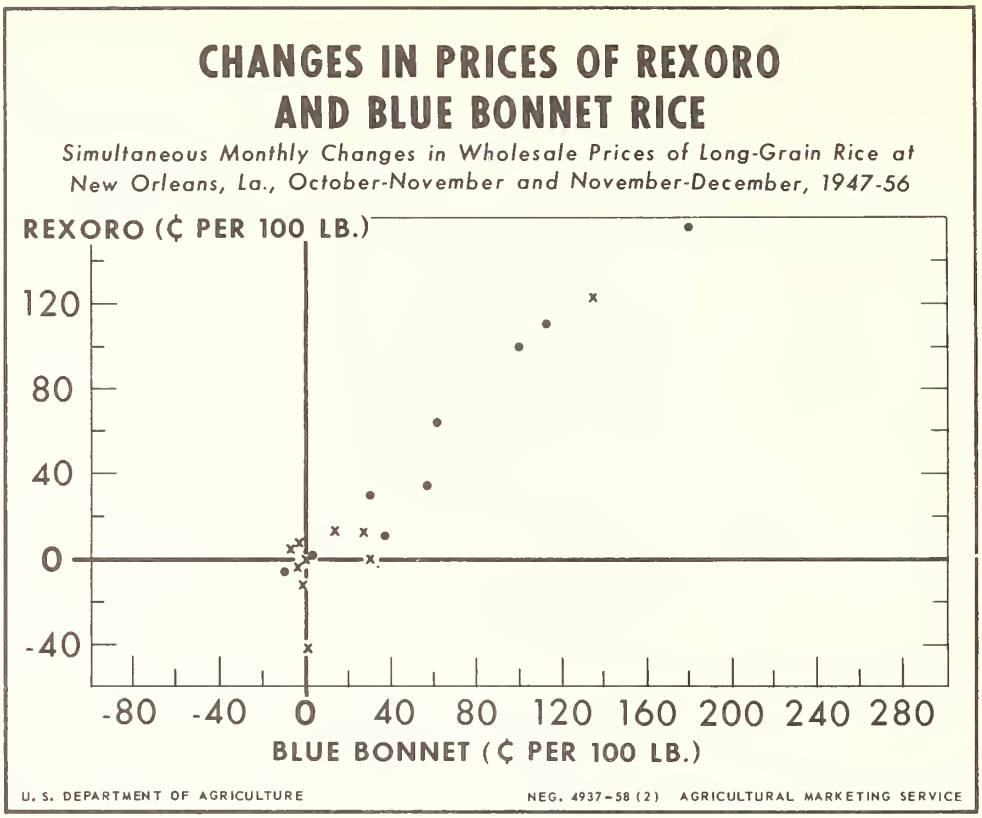

Figure 2

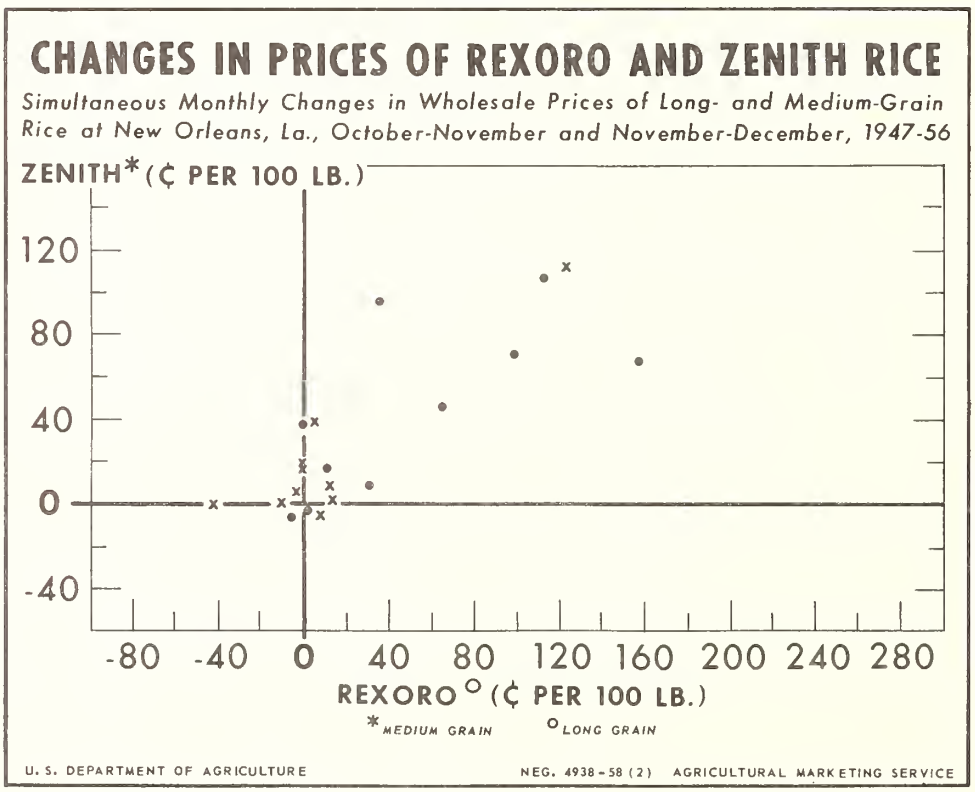

Figure 3

months and years. 9/ From even a casual observation it can be seen that the relationship between the price of the two long-grain varieties (fig. 2) is much closer than the relationship between the prices of medium- and long-grain rice (fig. 3).

Thus, month-to-month changes in the wholesale price of one variety of long-grain rice do not seem to occur independently of the simultaneous change in the wholesale price of another long-grain variety. The relatively weak relationship between prices of long- and medium-grain rice indicate some interdependence, but it is less pronounced. If, in any month, the price of one variety of long-grain rice increases, the wholesale price of another variety of long-grain rice is likely to increase about an equal amount. However, if the price of long-grain rice increases in any month, the price of medium-grain rice is also likely to increase in the same month, but on the average, the increase will be less pronounced.

The price analysis between selected varieties of rice was limited to the rice market of New Orleans. The findings, however, are not necessarily restricted to this market although adequate data are not available for testing intermarket price relationships.

DETERMINANTS OF RELATIVE PRICE LEVELS

The following analysis broadens the study to include relatively distant market areas in order to reflect more fully the average conditions of the entire southern rice industry. Further, the analysis includes the study of relative price levels of medium- and long-grain rice as they are influenced by respective supplies, and the determination of other useful relationships. This is in contrast to the study in the earlier sections in which relationships between absolute price levels only were analyzed. In addition to providing useful information for marketing decisions, the analysis will also serve to test the interpretation of the statistical results obtained in the earlier sections.

Years Without Price Supports, 1946-53

In Appendix B, a theoretical model is developed to analyze the relationship between price and production ratios of medium- and long-grain rice for the main part of the marketing season. 10/ This model shows that the type of rice in short production will sell at a relatively higher price later in the season than in the early months compared with prices of other types of rice. The assumptions upon which the model was built are than verified through statistical investigations.

9/ Apparently this relationship is the strongest in the heaviest wholesale marketing months when supplies of all three grains are relatively abundant. Later this relationship tends to become less strong, though the general tendency of the price movement is still in evidence.

10/ For this part of the study supply and production are used interchangeably in view of the relatively small carryover in the period under consideration.

Estimating equations were established for each month from September to February from which monthly relative price levels can be calculated from given supplies of medium- and long-grain rice. Time series data and the method of regression analysis were used.

The period 1946-53 was studied. Later years were excluded because Government price support operations in recent years tended to fix relative prices and thus they did not necessarily reflect relative supplies.

Two kinds of wholesale market price quotations were used. The medium-grain rice was represented by the monthly average of weekly quotations of Zenith at New Orleans, La. Prices of long-grain rice were monthly weighted prices of three varieties quoted at Houston, Tex. Production weights for Texas were assigned to the respective long-grain varieties of Blue Bonnet, Rexoro, and, since 1952, Century Patna. It was assumed that price quotations of Zenith and the selected long-grain varieties adequately represented prices of both medium- and long-grain rice in the South. Year after year, Louisiana produces a substantial part of the total United States crop of medium-grain rice, primarily of the Zenith variety. Texas produces mainly long-grain rice, and its production is a large proportion of the United States output of long-grain rice.

Supplies were represented by production of medium- and long-grain rice in the United States. These two types are grown largely in the Southern States; California, the only other large rice-producing State, does not produce them in substantial amounts. Because of the lack of adequate data, supplies by types were not adjusted for the annual carryover. It is believed that omission of the annual carryover did not materially affect the result of the analysis, since end-of-year stocks during the period of study were not significant.

Substitution Between Different Types of Rice

One way to verify the proposition that the two types of grain are to some degree substitute commodities is through an approximation of the concept of net demand elasticity. 11/ In general, the net demand elasticity for a specific type of rice will be low when supplies of that type are small and high when supplies are large. When supplies of long-grain rice are relatively small, the trade quickly absorbs the existing supplies, and the additional demand raises the price of this type of rice above its normal relationship to medium-grain prices. Price elasticity, however, cannot become infinitely low. If prices of long-grain rice were too high in relation to prices of medium-grain rice, consumers would turn to substitute commodities even though they preferred

11/ Net demand elasticity or, in this case, price elasticity can also be interpreted as a pure number resulting from dividing a given percentage change in the quantity by the corresponding percentage change in price when price-quantity relationships are studied. If the value of the ratio is above 1, it is customary to say that price elasticity is high or that the commodity is price elastic. In general, this means that the commodity in question has substitutes. If the value of the ratio is below 1, the commodity is said to be inelastic or that price elasticity is low. In this case the commodity has fewer substitutes.

long-grain rice. The closest and most logical substitute for long-grain rice, of course, is expected to be medium-grain rice. In the absence of extraordinary changes in demands and with large supplies of long-grain rice, the trade can easily satisfy all demands for this type of rice. Thus, its price will not be significantly affected by changes in demand for long-grain rice. For example, in October a 1-percent change in the annual production of long-grain rice would have been associated with a change only about 1/4 as large in the wholesale price quotations of long-grain rice in the opposite direction, if the price and production of medium-grain rice had not changed. By February, a 1-percent change in the annual production of long-grain rice would have produced about two-thirds as large a percentage change in the wholesale price quotation of the same type of rice in the opposite direction, if the price and production of medium-grain rice had remained unchanged.

Based on this analysis, the value of net average price elasticity for long-grain rice appears to be -3.32 and -1.48 for October and February respectively. 12/ That the value is above the numerical value of 1 suggests that the two types of rice are to some extent substitutes. This means that whenever supplies of one type of rice are in abundance (October), variations in demand for that type of rice will not materially alter its price in relation to the prices of other types of rice. The wholesale prices of the two types of rice thus will behave as if they were fairly good substitutes for each other. However, when one type of rice becomes scarce (February), mainly because of short production, changes in demand for that type of rice will in some years significantly affect its price in relation to the prices of other types of rice. Wholesale prices of rice under these conditions will reflect a less ready substitutional relationship. The same general conclusion will hold also for medium-grain rice.

Effect of Supplies on Seasonal Prices

The study of the data indicate that, on the average, in September annual production ratios of the two types of rice explained only about 31 percent of the variations in their respective price ratios. Monthly price ratios were gradually explained better by annual production ratios as the season advanced. 13/ By February, annual production ratios explained 91 percent of the variations in February price ratios.

As indicated, early in the season both types of rice tend to be abundant, mainly because of the seasonal nature of milled rice marketings. Variations in demand for different types of rice in relative abundance did not influence relative prices significantly. With the advance of the season available supplies of different types of rice became more and more apparent. It became increasingly difficult to satisy the preferences of consumers, including

12/ Approximated values of monthly net demand elasticities are tabulated in Appendix B, table 11.

13/ As shown in Appendix B, table 11, the correlation coefficient increases as the season advances, reaching the highest value in February.

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foreign consumers, for the type of rice in short supply. Consequently, a scarcity of that type of rice developed. Thus, shortage in a given type of rice, because of small production became more and more apparent as the season progressed.

Seasonal Shifts in Price Ratios

The price and actual production ratios are plotted in figure 4 for October and February. 14/ This figure shows that in a year with a relatively small crop of medium-grain rice, for example, 1951, the price of this type of rice tended to be relatively lower in the early month of the season (October) and higher later in the season (February), if compared with prices of long-grain rice. On the other hand, when the crop of medium-grain rice, in relation to the crop of long-grain rice, was larger, for example, 1949, the price behavior of this type showed a reverse tendency. At or near the equilibrium output point, monthly price ratios tended to remain stable during the first 6 months of the marketing season. 15/

The seasonal fluctuations in relative price levels are difficult to explain in view of the information available to the trade about the composition of the rice crop early in the season. One would expect that different types of rice would be sold in those months in which they would bring the highest return in relation to prices of other types of rice when neither a general increase nor decline in price level is expected. Yet the major part of the industry has not been following such a sales policy. Apparently institutional factors and the well established marketing practices in the industry prevent many millers from delaying sales of the type of rice in short supply. Some of these factors and practices are as follows:

(1) Not all rice that is produced passes through the wholesale trade. Not only is there a substantial amount of rice sold in packaged form, mainly in the domestic market, but year after year large amounts are shipped directly to regular customers at contract price. In these cases millers may not be in a position to delay sales until the price of the type of rice ordered becomes more favorable than it is at the time when deliveries are due.

(2) It may be difficult for the miller, who sells his product in carlots to jobbers or large wholesale or chainstore operators, to delay sales and wait until the price becomes more favorable. Competition for markets is apparently keen and delaying sales may mean losing important market outlets.

14/ Price ratios are calculated ratios from the corresponding regression equations appearing in Appendix B, table 11.

15/ Equilibrium output, as used in this study, is defined as that output ratio of medium- and long-grain rice which would keep the price ratio of medium- to long-grain rice stable over the marketing season.

The forthcoming supplies of other competing foodstuffs, like potatoes, will not be likely to affect prices differently because the two types of rice are fairly good substitutes. Consequently, price ratios can be thought to remain largely independent of prices and supplies of other competing foods.

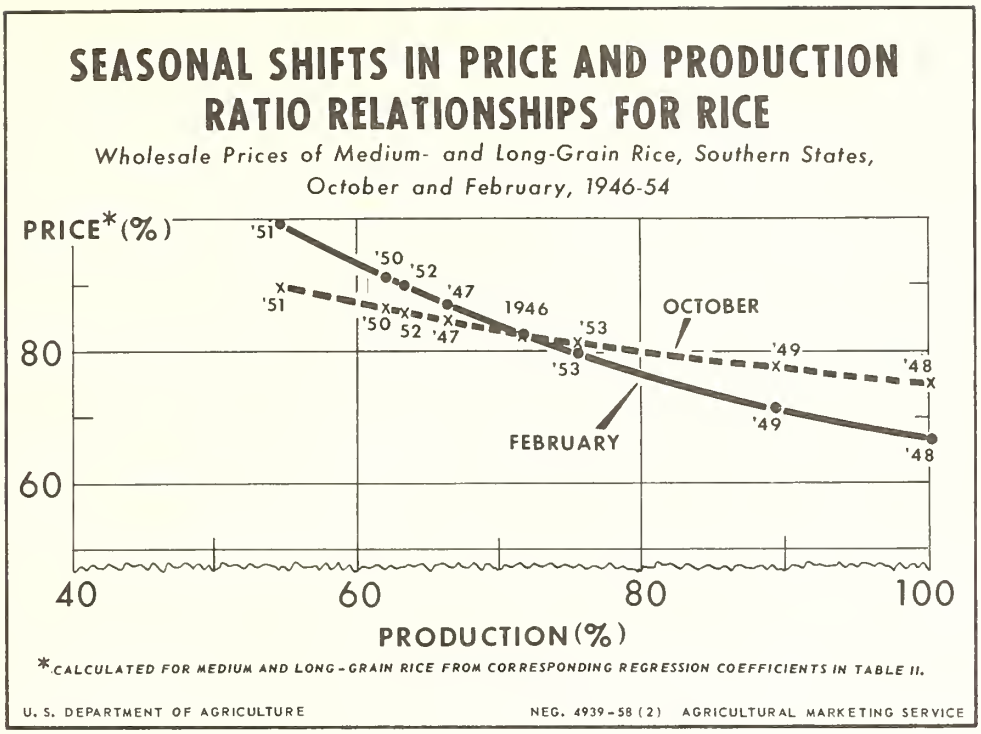

Figure 4

(3) Not all mills handle more than one type of rice for the wholesale trade. Their monthly sales of some types of rice may be small compared with the annual supply. Thus, even if they followed a more profitable selling pattern, they would exert only a minor impact upon relative price levels.

(4) Mills handling predominantly one type of rice have only one alternative; that is, selling their entire stock of milled rice early in the season or holding it for later delivery. In many cases, financial problems and the fear of losing markets later in the season may prevent them from holding rice in storage for several months. This may also be true for mills handling different types of rice.

(5) Accepted milling practices may also contribute to the instability of relative prices. Some mills operate for only a few months during the marketing season; this practice contributes to the abundance of both types of rice early in the season. Thus, later in the season wholesale supplies will represent mainly sales by mills which operate during the entire season.

(6) The risk in holding all types of rice for later sale tends to force millers to sell early. Even though the price of one type of rice may be more favorable later in the season, a general price decline may cause severe losses to the millers.

(7) There is always a possibility that demand conditions for specific types of rice may change. Such changes may not have a significant effect upon relative prices when all types of rice are abundant, as they are early in the season. Later, however, when a scarcity develops for a specific type of rice, changes in demand for that type may have favorable as well as unfavorable effects on millers' returns.

(8) Inadequate available storage space to hold rice for later sales may be another factor. However, there seems to be no evidence of a shortage in storage space. Current storage facilities for rice appear to be adequate to accommodate a good part of the annual supply.

A more accurate appraisal of the seasonal price behavior observed previously is prevented by lack of adequate information on the structural composition of the industry and on marketing practices followed by different mills.

Impact on Marketing Margins and Costs

The implication of the above findings should be viewed in terms of their impact upon alternative gross milling margins.

The regular pattern of seasonal shifts in relative price levels indicates that the industry did not operate under stable relative price conditions. At the time when different types of rough rice were being purchased from the producers, some millers probably were inclined to allow for a larger milling margin for all types of rice in order to reduce the risk. This in turn may have affected prices paid to producers. The seasonal changes in the relative wholesale price levels also show that different types of rice brought different returns to the millers. Such differential returns may have affected millers' incomes.

With information available about prospective supplies of different types of rice, the impact on milling margins depends on the degree by which the industry can pursue a selling policy on the wholesale market to turn such information to its advantage. If only a few millers timed their sales of alternative types of rice advantageously, their gross margins would be increased considerably. For example, figure 4 suggests that if supplies of medium-grain rice were expected to be short in relation to supplies of long-grain rice and if no general price decline was expected, early sales of long-grain rice and late sales of medium-grain rice would be more profitable than if all rice were sold early in the season (a practice which has been quite common with several mills). 16/ With large supplies of medium-grain rice the reverse selling policy would be more profitable.

If all millers, including those operating only a few months in the season, were able to follow the same sales policy and sell each type of rice when it

16/ This sales pattern and the impact on marketing may be applicable for use in later years if price supports are discontinued and if demands and preferences for different types of rice do not change significantly.

would bring the highest return on the wholesale market in relation to alternative types, seasonal fluctuations in relative price levels would be considerably reduced. This would likely benefit the industry. Benefits would accrue not only to the producers but also to the millers, whose problems would largely be restricted to estimating general instead of relative prices. 17/ Consequently, the industry would be operating under more stable conditions. 18/

In general, benefits to the millers from an appropriate timing of rice sales would be larger the greater the deviation of relative supply was from "equilibrium output" and the smaller the volume of rice handled in such a fashion. With large deviations, monthly differences in relative price levels also would tend to be large, particularly later in the season (fig. 4). Further, the smaller the volume of sales was later in the season (of the type in short supply), the smaller its impact would be upon relative prices. At equilibrium output there would be no need to time sales of different types of rice, for relative price levels over the season would remain stable, provided again that no extraordinary demand developed for one or the other type of rice.

On the basis of tables 6 and 7, a numerical example can demonstrate the potential monetary advantages of selling rice at wholesale when the price becomes more favorable. If a miller had sold 10,000 bags of long-grain and 10,000 bags of medium-grain rice in October 1951, his combined sales in that month would have realized him about $188,900. With information available about the relative supplies in October, he should have known that prices of medium-grain rice would be higher relative to long-grain prices in February than in October. Assuming that a general price decline would not be expected during the season, he then would have held off selling medium-grain rice until February. By selling the long-grain rice in October and the medium-grain rice in February he would have realized $203,000 in gross revenues, or about $14,100 more. This would have been more than enough to compensate him for the 5 months' storage charges, which would not have amounted to more than $1,500, assuming a storage charge of about 3 cents per month per 100 pounds. It should be remembered, however, that if the whole industry had been able to follow the same sales policy, individual advantages would have largely disappeared, because monthly relative wholesale prices would have remained stable.

Years With Price Supports, 1954-57

Problem of Supplies

Government price support programs for rice are designed to assure the rice grower support on his crop according to the provisions of the Agricultural

17/ From one season to the next relative prices may be different depending on relative supplies. However, during any season, once relative price levels have been established, they will not fluctuate significantly.

18/ Stability of course could still be disturbed by sudden extraordinary changes in demand conditions for specific types of rice.

Act of 1949, as amended. The Department's primary administrative duties are to (1) assure the producers of the support price prescribed by the Act and (2) adjust aggregate rice supplies to the current demand for rice.

In the context of the problem considered in this report, the important consideration is to determine the effect of program operations on supplies of different types and varieties, and the marketing problems encountered. These problems are largely associated with the establishing of support rates for different types and varieties of rice.

If price support programs establish a support rate too high for one type of rice, this type will tend to move into Government storage and another type for which a lower support rate is established will move into the milling trade. The marketing problem for the rice millers during periods of effective Government programs becomes one of learning not only how aggregate rice supplies are affected but also how relative support rates will affect the supplies of different types of rice.

Given aggregate rice supplies, millers are not only forced to compete with established support rates, but in some cases they may be forced to pay premiums over support prices.

In the long run the problem is to estimate how producers will react to relative support rates. If rates for one type of rice are established at a level more favorable than for other types, producers will tend to expand production of that type of rice at the expense of other types. Millers, on the one hand, would still have to compete with Government support rates for the type of rice with high support rates. On the other hand, supplies of rice for which unfavorable support rates were established will gradually become scarce, and millers will have to compete for the short supplies, paying in some cases considerable premiums over support prices.

In the 1955-56 and 1956-57 seasons, both years of heavy Government storage operations, much long-grain rice but relatively small amounts of medium-grain rice moved into Government storage, as indicated in table 3. Apparently since the 1954-55 season the price support rate for long-grain rice has been higher than the existing demand-supply relationships justified.

The effect of the relatively high support rate for long-grain rice on production is indicated in table 4. Aggregate production of all rice has been declining since the 1954-55 season because of acreage restrictions and marketing quotas. However, the decline is mainly in output of medium-grain rice since production of long-grain rice has remained about the same. Medium-grain rice production in 1954 was about 21 million hundredweight, and by 1956 it had fallen more than 50 percent, to about 9 million hundredweight.

That production of long-grain rice has become more profitable in recent years than production of medium-grain rice is evidenced by the changes in relative value factors used to compute price support rates for different varieties. For example, in 1954 the value factor for Patna and Rexoro, both widely grown long-grain varieties, was about 20 percent above the value factor

Table 3.--Quantities of medium- and long-grain varieties of rough rice under Commodity Credit Corporation loans and purchase agreements, Southern States, as of the 15th of each month, September-February 1954-57

Year and month	Medium-grain rice	Long-grain rice
	1,000 cwt.	1,000 cwt.
1954:		
September	---	---
October	1/5,047	
November	1/9,950	
December	5,396	8,142
January	6,535	9,700
February	6,903	10,409
1955:		
September	---	---
October	---	2,485
November	383	6,284
December	1,077	10,842
January	1,316	12,551
February	1,549	13,414
1956:		
September	---	---
October	50	1,782
November	100	5,505
December	249	9,248
January	320	10,500
February	362	11,165

1/ Not available by types and varieties.

AMS Market News Service.

for Zenith, a dominant medium-grain rice variety. The value factors for these two long-grain varieties were 27 percent above the value factors for Zenith in 1955 and nearly 33 percent above in 1956. Similar increases were observed in the relative value factors for other long-grain varieties, like Blue Bonnet and Century Patna, compared with Zenith.

The preliminary value factors for the coming marketing season are usually announced before the planting season begins and are subject only to minor changes. Rice growers, consequently, have a fairly good base for their decision regarding the variety they will plant. Their decision is usually made

Table 4.--Production of rough rice in the Southern States by selected types, 1946-56

Year	Medium grain	Long grain
	1,000 cwt.	1,000 cwt.
1946	10,280	14,301
1947	10,460	9,699
1948	14,959	9,211
1949	14,032	9,672
1950	11,188	17,998
1951	12,178	22,240
1952	14,379	22,634
1953	17,565	23,200
1954	20,989	26,762
1955	14,606	26,469
1956	9,144	26,071

The Rice Millers' Association. Rice Production in the United States. Annual reports.

on the basis of expected gross returns per acre which, among other things, will be influenced by the price they expect to obtain. Since the expected prices for long-grain rice varieties in recent years were more favorable than the expected prices for medium-grain rice varieties, production of medium-grain rice decreased while production of long-grain rice remained about the same.

The rice milling industry recognizes the problems associated with higher support rates for long-grain rice. It also recognizes that these problems partially originate from the price support legislation designed to help the rice growers. That current higher support rates for long-grain rice are mainly due to the movements of wholesale prices in recent years of different varieties of rice is perhaps less well known. Industry sources, however, indicate that in some areas millers of long-grain rice have found it increasingly difficult to obtain this type of rice from the farmers. Millers indicate that in some cases they were forced to pay premiums over support rates in order to obtain the type of rice they wanted. It is believed that the support rates established for several varieties of long-grain rice in relation to rates for medium-grain rice were significantly higher than existing demand conditions would warrant. So long as medium-grain rice was plentiful, millers had no problem obtaining that type of rice. However, in recent years supplies of medium-grain rice were so short that millers were forced to pay considerable premiums over support prices in order to obtain this type of rice also. This in turn had an adverse impact upon millers' incomes.

Possible Value in Determining Price Support Rates

The importance of establishing the Government price support rates (value factors announced by the Department of Agriculture) at levels which will result in normal production, storage, and availability of the different types of rice for milling thus becomes apparent. Figure 4 suggests, although it is not a supply-response relationship, that establishing price support rates for different varieties of rice at more normal levels would be likely to result in a more normal production pattern and as a consequence would also tend to normalize supplies of each type of rice in Government storage and in milling. 19/ It would also remove some of the millers' and farm producers' problems associated with differential support rates.

Planning Marketing Operations

When support prices for the different types of rice are out of balance with their relative demand, support prices and their probable effect on free supplies (supplies available to commercial trade) become a dominant factor for the milling trade to consider. Actual production and supply become more of an academic consideration. Monthly variations in relative free supplies, after adjusting for CCC holdings, had almost no effect on relative prices during the first 6 marketing months in 1954, 1955, and 1956 (table 5). While wide variations can be observed in free supply ratios, price ratios show very little variation.

In times of effective price support programs the fixed support rates are likely to stabilize wholesale prices over the marketing season. Such stabilization, however, must be distinguished from changes in relative price levels that may occur from one season to the next. Free supply ratios may still affect price ratios from one year to the next, but during any marketing season price ratios would tend to remain stable. Under these conditions no consideration needs to be given to the months in which sales of different types of rice would bring higher returns. Storage costs in general would still merit consideration. However, to the extent that storage charges for medium- and long-grain rice are the same, relative price levels would remain unaffected.

19/ If the implications of the relationships shown in figure 4 were to be used for this purpose, it would be necessary to develop supply-response relationships for different varieties, since several varieties have different support prices. Basically, it would mean that price support rates would be established on the basis of relative price levels rather than on the basis of absolute prices.

Table 5.--Free supply and price ratios of medium- to long-grain varieties of rice, September-February 1954-56

Year and month	Ratios of medium- to long-grain rice	
	Free supply 1/	Price 2/
	Percent	Percent
1954:		
September	3/	---
October	3/	---
November	81.8	---
December	83.7	88.8
January	84.7	90.5
February	86.1	89.4
1955:		
September	55.2	88.7
October	60.9	88.1
November	70.5	91.8
December	86.6	91.9
January	95.5	90.8
February	100.0	89.0
1956:		
September	35.1	88.5
October	37.4	87.9
November	44.0	86.8
December	52.9	87.2
January	56.7	87.9
February	58.9	87.6

1/ Production ratio of medium- to long-grain rice adjusted for Commodity Credit Corporation's holdings (loans and purchase agreements).

2/ Ratio of Zenith No. 2 at New Orleans to Blue Bonnet, Rexoro, and Texas Patna at Houston weighted by respective production in Texas.

3/ No breakdown available on Commodity Credit Corporation's stockholdings by types of rice.

Market News Service

Table 6.--Monthly average wholesale price of milled rice at New Orleans, La., selected varieties, 1946-56

Variety and crop year	Price per 100 pounds											
	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July
	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.
Zenith:												
1946	6.50	8.05	8.05	8.90	8.90	8.90	8.90	8.90	8.90	8.90	8.90	13.25
1947	12.75	11.00	11.00	12.08	12.15	12.67	13.42	12.77	12.58	13.15	15.50	---
1948	9.75	8.90	8.45	9.13	10.25	9.75	9.35	9.30	9.25	9.12	8.87	8.67
1949	8.25	7.08	7.03	7.75	8.14	8.17	8.12	8.05	8.08	8.12	8.12	8.40
1950	9.00	8.45	8.90	9.87	9.85	9.95	10.03	10.53	10.50	10.50	10.39	10.38
1951	9.16	8.33	8.96	9.42	9.59	10.00	10.44	10.50	10.50	10.55	10.50	10.50
1952	10.45	10.37	10.58	10.67	10.75	10.75	10.75	12.25	12.37	12.37	12.37	12.18
1953	9.47	8.65	9.19	9.36	9.37	9.37	9.30	9.25	9.06	8.90	8.61	8.53
1954	7.46	7.50	8.21	9.17	9.37	9.37	9.37	9.58	10.57	11.25	11.25	10.65
1955	9.00	8.87	8.87	9.25	9.20	9.09	8.90	8.80	8.71	8.77	8.37	8.43
1956	8.35	8.44	8.53	8.50	8.50	8.60	8.88	8.93	8.87	---	---	---
Rexoro:												
1946	8.25	9.90	9.90	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.60	15.80
1947	15.00	12.66	13.00	14.13	14.10	14.67	14.75	14.60	14.78	15.50	16.81	17.70
1948	17.00	16.50	11.00	12.57	13.80	13.68	13.47	13.95	13.75	13.58	13.12	12.50
1949	12.35	---	9.37	10.37	10.42	10.35	10.12	10.05	10.08	10.12	10.12	10.65
1950	11.25	10.75	10.60	10.62	10.75	11.10	11.19	11.61	11.50	11.50	11.27	11.25
1951	10.25	8.73	9.60	10.25	10.25	10.39	10.61	10.62	10.79	11.54	11.96	12.00
1952	---	11.17	11.56	11.87	12.00	12.00	12.00	13.69	13.97	14.37	14.37	14.25
1953	12.25	---	11.00	11.11	11.00	11.00	11.00	11.00	11.00	10.95	10.67	10.57
1954	10.25	10.50	10.90	11.25	11.25	11.25	11.25	11.33	11.73	12.13	11.87	11.75
1955	10.82	10.62	10.62	10.62	10.70	10.66	10.62	10.60	10.37	10.34	10.02	9.90
1956	9.65	9.87	10.12	10.07	9.65	9.86	10.50	10.62	10.43	---	---	---

Continued --

Table 6.--Monthly average wholesale price of milled rice at New Orleans, La., selected varieties, 1946-56--Continued

Variety and crop year	Price per 100 pounds											
	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July
	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.
Blue Bonnet:												
1946	8.25	9.90	9.90	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.60	15.80
1947	14.00	14.33	13.00	14.13	14.10	14.55	15.00	14.60	14.80	15.00	---	17.75
1948	---	10.50	10.65	12.45	13.80	13.38	13.47	13.95	14.00	---	---	---
1949	---	9.75	9.32	10.37	10.33	10.09	10.00	9.81	9.70	9.62	9.62	10.05
1950	11.25	10.75	10.59	10.62	10.75	10.50	11.00	11.20	11.50	11.50	11.31	11.25
1951	10.25	8.73	9.13	9.75	9.75	10.00	10.35	10.50	10.60	11.10	11.89	12.00
1952	12.00	10.94	11.31	11.62	11.90	12.00	12.00	13.75	13.97	14.37	14.37	14.25
1953	11.58	10.25	10.50	10.88	10.87	10.87	10.87	10.79	10.56	10.70	10.42	10.32
1954	9.71	9.50	9.88	10.45	10.75	10.75	10.75	11.00	11.72	12.12	11.87	11.59
1955	10.71	10.50	10.50	10.50	10.47	10.37	10.19	9.94	10.12	10.06	9.38	8.98
1956	9.07	9.37	9.56	9.47	9.48	9.56	9.94	10.00	9.93	---	---	---

1/ Simple average of all weekly quotations, f.o.b. mills.
AMS Market News Service.

Table 7.--Monthly average wholesale price of milled rice at Houston, Tex., selected varieties, 1946-56 1/

Variety and crop year	Price per 100 pounds											
	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July
	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.
Rexoro:												
1946	8.25	9.90	9.90	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.60	15.80
1947	13.00	13.62	13.37	13.75	14.15	14.50	15.25	15.25	15.25	15.90	17.00	17.00
1948	16.80	11.00	11.25	12.50	13.60	13.85	14.24	13.75	13.75	13.75	13.75	13.75
1949	13.62	---	9.60	10.50	11.25	11.10	10.45	10.45	10.50	10.62	10.62	11.65
1950	12.50	10.70	10.97	11.81	11.60	11.75	11.85	11.79	11.85	11.70	11.40	11.30
1951	10.40	9.00	10.55	10.40	10.40	10.65	10.65	10.70	11.05	11.50	11.90	12.00
1952	11.35	11.65	11.85	11.90	12.00	12.00	12.00	14.50	14.85	14.95	15.00	13.95
1953	11.10	11.15	11.70	11.80	11.75	11.75	11.75	---	---	---	---	---
1954	10.50	10.85	11.10	11.15	10.95	10.50	10.95	11.35	11.55	11.90	11.75	11.45
1955	10.70	10.75	10.95	10.90	10.90	10.90	10.90	10.90	10.90	10.80	10.75	10.65
1956	10.35	10.30	10.40	10.45	10.40	10.40	10.65	10.65	10.65	---	---	---
Blue Bonnet:												
1946	8.25	9.90	9.90	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.60	15.80
1947	13.00	13.62	13.25	13.50	13.90	14.33	15.25	15.25	15.25	15.90	17.00	17.00
1948	16.83	11.40	11.00	12.50	13.60	13.85	14.25	13.75	13.75	13.75	13.75	13.75
1949	13.62	9.97	9.35	10.50	11.25	11.10	10.45	10.45	9.45	10.62	10.62	11.65
1950	12.15	10.78	10.72	11.60	11.50	11.75	11.90	11.67	11.85	11.70	11.25	11.20
1951	10.40	8.40	9.50	9.65	9.90	10.25	10.40	10.40	10.55	10.80	11.80	12.00
1952	11.40	11.00	11.60	11.70	12.00	12.00	12.00	14.50	15.00	14.95	15.00	13.95
1953	11.75	10.30	11.05	11.10	11.00	11.15	11.15	---	---	---	---	---
1954	9.55	9.75	10.45	10.70	10.65	10.25	10.65	11.15	11.45	11.70	11.70	11.10
1955	10.40	10.45	10.40	10.45	10.30	10.35	10.30	10.35	10.30	10.25	10.15	9.90
1956	9.75	9.80	9.80	9.80	9.75	9.85	10.15	10.15	---	---	---	---

Continued --

Table 7.--Monthly average wholesale price of milled rice at Houston, Tex., selected varieties, 1946-56 1/--Continued

Variety and crop year	Price per 100 pounds											
	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July
	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.	Dols.
Century Patna:												
1952	11.35	11.00	11.65	11.70	12.00	12.00	12.00	---	---	---	---	---
1953	---	10.30	11.00	11.10	11.00	11.15	11.15	---	---	---	---	---
1954	8.80	8.85	9.80	9.70	9.90	9.50	10.20	10.60	10.80	10.95	10.90	10.40
1955	9.05	9.40	9.45	9.40	9.35	9.35	9.30	9.30	9.25	9.20	9.00	8.80
1956	9.75	8.90	9.25	9.40	9.35	9.35	9.90	9.90	9.90	---	---	---

1/ Simple average of all monthly quotations f.o.b. mills.
Market News Service.

Table 8.--Measures of variability in monthly average wholesale prices of rice, selected varieties, New Orleans, La., October-March, 1947-57 1/

Type and variety	Standard deviation per 100 pounds					
	October	November	December	January	February	March
	Cents	Cents	Cents	Cents	Cents	Cents
Medium-grain:						
Zenith	107.7	112.0	108.6	118.9	143.9	148.7
Long-grain:						
Rexoro	97.5	120.0	141.1	146.4	140.7	160.9
Blue Bonnet	106.8	131.5	150.0	153.1	163.4	175.8

Type and variety	Coefficient of variations per 100 pounds					
	October	November	December	January	February	March
	Percent	Percent	Percent	Percent	Percent	Percent
Medium-grain:						
Zenith	12.0	11.8	11.2	12.2	14.6	14.9
Long-grain:						
Rexoro	9.0	10.6	12.4	12.7	12.2	13.6
Blue Bonnet	10.2	11.9	13.4	13.7	14.4	15.2

1/ Computed on the basis of table 6.

Table 9.--Association between monthly wholesale prices of rice, selected varieties, New Orleans, La., October-March 1947-57 1/

Variety	Correlation coefficient squared					
	October	November	December	January	February	March
	Percent	Percent	Percent	Percent	Percent	Percent
Zenith and Rexoro	68.3	59.8	69.5	63.9	61.7	57.6
Zenith and Blue Bonnet	67.9	57.5	67.8	64.4	62.8	57.6
Rexoro and Blue Bonnet	92.2	96.3	93.0	98.9	99.7	98.7

1/ Computed on the basis of table 6.

Table 10.--Effect of a 1-dollar change per 100 pounds in the price of one variety of rice upon the price of another variety, New Orleans, La., by month, October-March, 1947-57 1/

Regressions between selected varieties	Regression coefficients cents per 100 pounds					
	October	November	December	January	February	March
Rexoro on Zenith	.91	.72	.64	.65	.80	.70
Blue Bonnet on Zenith	.83	.65	.60	.62	.70	.64
Blue Bonnet on Rexoro	.88	.89	.90	.95	.86	.91

1/ Computed on the basis of table 6.

APPENDIX B

Theoretical Model

In this section, a theoretical framework will be established in order to provide for the mechanism by which relative price levels for medium- and long-grain rice can be determined during the months of the main marketing season. The model specifies the data which must be obtained and the relationships among them which must be measured.

Three assumptions are necessary to establish such a framework:

(1) Medium- and long-grain rice are substitutes but not perfect substitutes.
(2) Early in the season when supplies are abundant, relative prices tend to be largely independent of supplies and of variations in relative demands.
(3) As the season progresses, relative prices will reflect more and more the relative supplies available.

Relative Price Determinations

On a given market and at a given time, the price of a homogeneous commodity is determined by demand and supply. Shifts in demand or supply may cause changes in prices at different times of the season and in different seasons. If a commodity has a substitute, even though it may not be a perfect substitute, the major determinants of demand--population change, income and its distribution,

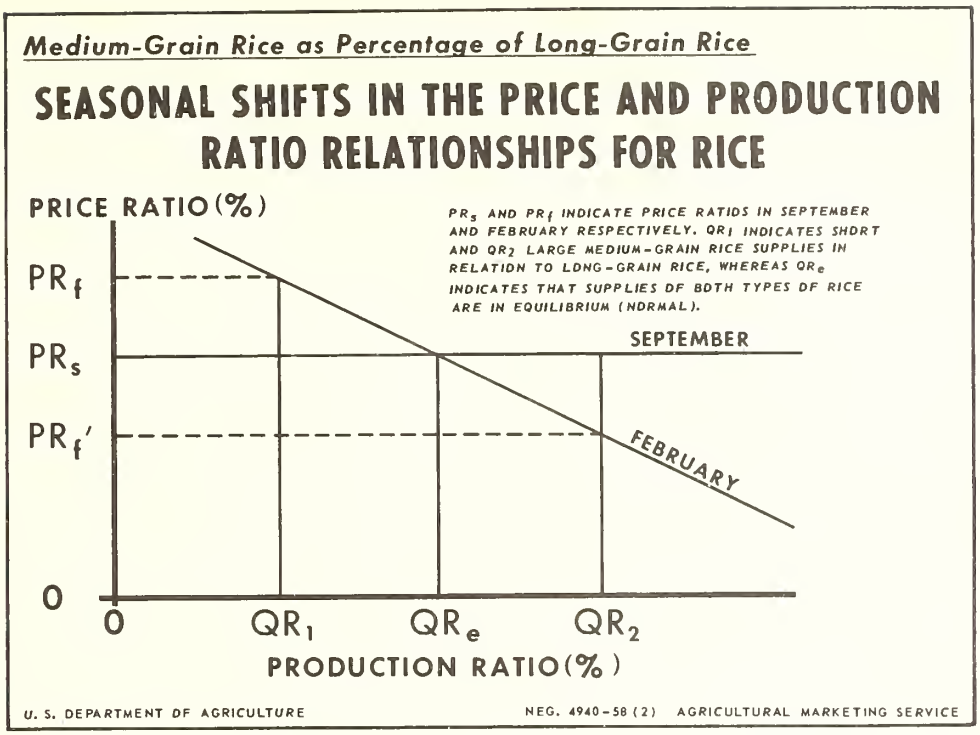

Figure 5

and prices of the commodity and its substitute--will not affect the prices of the two commodities much differently. 20/ If changes in the main determinants of supply--such as input-output or production-engineering relationships, and production costs--also did not affect prices of the two nonperfect substitute commodities differently (an assumption which in this study is fairly reasonable) then the only factor remaining which may affect prices differently will be the availability of supplies of the two commodities. Thus, if the price of one commodity is expressed as a percentage of the price of its substitute, such relative prices will become a function of relative supplies. The relationship will slope downward, indicating that as the supply of one commodity increases in relation to the supply of its substitute, the price of the commodity will decline in relation to the price of its substitute. If the two commodities are marketed seasonally at about the same time, the relationship will likely have different slopes at different times of the marketing season, depending on the supplies available for trade.

The model for rice described above is shown in figure 5. The vertical axis represents the price of medium-grain rice expressed as a percentage of the price of long-grain rice. The horizontal axis represents medium-grain supplies expressed as a percentage of long-grain supplies.

20/ This also assumes that there is no major change in preference for the two substitute commodities.

Let QR_1 in any season indicate short production in medium-grain rice. At the beginning of the season (September), when market supplies of all types of rice are abundant, relative price levels will remain large independent of relative supplies. Because of the development of scarcity in medium-grain rice supplies later in the season(February), the price of this type will rise above its normal relation to the price of long-grain rice PR_f. If on the other hand, supplies of medium-grain rice were in relative abundance, QR_2, its price would fall below its normal relation to prices of long-grain rice later in the season PR_f^1. 21/

Figure 5 also indicates that seasonal fluctuations in relative price levels would be minimized at or near QR_e relative output. Quantification of the relevant monthly relationships is the main objective of the following sections. Monthly data on prices and yearly production for medium- and long-grain rice are necessary. The solution for that relative output which would maintain stability in relative prices over the main part of the marketing season can be obtained by simultaneously solving any two functions pertaining to relative prices and production for any 2 months in the main part of the season.

Price Ratio Function

Six equations were obtained--one for each month from September through February. 22/ Prices and production both were expressed in relative terms, the values of medium grain as a percentage of long-grain values. Since prices from September to February could hardly have any effect upon production in the same season--an assumption which might be reasonable in times when no price support programs are effective--price ratios were taken as dependent variables and production ratios as independent variables. All equations were expressed in logarithmic form. Log X_1 in each case represented the logarithm of seasonal production ratios of medium- to long-grain rice while Log X_2. . . Log X_7 referred to the logarithm of price ratio of medium- to long-grain rice in the same season, beginning with the month of September and ending with the month of February. Results of the statistical regression analysis are tabulated in table 11.

21/ Approximately the same general conclusion would also hold for long-grain rice if the values of long-grain rice were expressed as a percentage of medium-grain values. This must be so, since a scarcity in one type of rice must also represent relative abundance in the other types.

22/ In some years price quotations for certain varieties of rice for the period March-August were not available. These months therefore were excluded from the statistical regression analysis. In any case, March-August marketings of rice in most years were small compared with the seasonal total.

Table 11.--Coefficients for the statistical regression analysis of monthly price ratios of medium- and long-grain rice (Log X_2 to Log X_7) 1946-53

Month	Constant term : a	Coefficient of production ratio (Log X_1): b	Correlation coefficient : r	Approximated elasticity (1/b)
September ..	2.4048	-0.2630	-0.556	-3.8022
October	2.4760	-0.3009	-0.885	-3.3233
November ...	2.6459	-0.3886	-0.906	-2.5667
December ...	2.6068	-0.3684	-0.927	-2.7144
January	2.7261	-0.4340	-0.946	-2.3041
February ...	3.1680	-0.6733	-0.952	-1.4852

Elasticity

The net price-quantity relationship for medium-grain rice can be calculated for each month in any year by introducing the appropriate realized magnitudes of long-grain supplies and prices for each month and year in the function relating price ratios to supply ratios. Introduction of one year's value in any month for these two variables leads to an adjusted net regression function relating the logarithm of medium-grain supplies as follow: Since the adjusted equation is a log-log relationship, this coefficient is an approximation of the coefficient of price flexibility. The inverse of the coefficient may define the limiting magnitude of the coefficient of demand elasticity. As a rough estimate then, the price elasticity of demand for medium-grain rice in any month is the inverse of the regression coefficient. Since this was derived from a logarithmic function, the same general conclusion should also hold for all years investigated. Approximately the same value of elasticity would be obtained for long-grain rice, if the values of long-grain rice were expressed as a percentage of the values of medium-grain rice. Under certain restrictive assumptions the inverse of the regression coefficient may be also interpreted as a rough measure of the elasticity of substitution between the two types of rice. That the numerical value is above 1 suggests again that long- and medium-grain rice are substitutes to some degree. 23/

23/ When price ratio-quantity ratio relationships are analyzed, in the absence of specific assumptions, it may be difficult to identify the regression coefficient or its inverse for a single commodity in the equation. However, within the limited interpretation and specification of the regression coefficient, as described above, net demand elasticity for one commodity can be approximated from a simple price ratio function. Discussion of the problems associated with interpretation of such a regression coefficient falls outside the scope of this report.

According to table 11 the previously defined price elasticity of demand for medium-grain and long-grain rice appears to be high, even though price elasticity of demand for all types of rice as a group may be low. 24/ The reason for this seemingly different finding lies in the method of analysis. In this study, price-quantity relationship of one type of rice was analyzed in terms of its expected potential substitute: another type of rice. A large percentage change in production in one type of rice, thus, is expected to induce only a small percentage change in its price if the price and production of its potential substitute remain unchanged. However, if the production of all types of rice increases by a given percentage, price of rice in general may decline by a larger percentage.

Seasonal Shifts in Relative Prices

Since the functions are expressed in logarithmic terms the regression coefficient of production tells in relative terms by how much price ratios change for a 1-percent change in production ratios. It will be observed that the numerical value of the regression coefficient remains below 1 but increases as the season advances. 25/ The change in the regression coefficient from month to month corresponds to the seasonal shift in the price ratio function shown in figure 5. The behavior of the regression coefficient, of course, is similar, but opposite in direction, to the behavior of the previously defined value of elasticity, since the latter is the inverse of the former.

24/ Mehren, G. L., and Thuroczy, Nicholas. The Market for United States Rice: Domestic. Calif. Agr. Expt. Sta., Giannini Found. of Agr. Econ. Rpt. 162. March 1954.

25/ Except for December when the decline from previous month is small.

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